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Residential, Commercial and Industrial (RCI) Sector GHG Reduction Opportunities

The following tables provide examples of actions to reduce GHG emissions in the residential commercial, and industrial sectors. The first table covers comprehensive opportunities – actions that would apply to all sectors, while the following three tables refer to actions for each of the three sectors. The list is neither exhaustive, nor are the categories necessarily distinct. The main goal is to provide a starting point for this process.

We have also included some examples of current activities in Arizona that fit under various categories. Again this is not meant as an exhaustive list. Instead it was developed from conversations with various Arizona experts and officials, combined with a review of three key sources:

A1/ADEQ Haze SIP report – *Regional Haze State Implementation Plan for the State of Arizona*, Air Quality Division Arizona Department of Environmental Quality, December 23, 2003 http://www.azdeq.gov/environ/air/haze/download/2sip.pdf

A2/SWEEP website – Southwest Energy Efficiency Project website, information downloaded March 22, 2005. http://www.swenergy.org/programs/arizona/index.html

A3/DSIRE website - Database of State Incentives for Renewable Energy (2005 Status), information downloaded March 22, 2005. http://www.dsireusa.org/library/includes/map.cfm?State=AZ&CurrentPageId=1.

To keep the tables relatively succinct, we have appended expanded descriptions of the sample current activities from each of these sources in the appendices and refer to the examples by a program/activity and the page number in the relevant appendix to consult for further details.

Key to Indicators: We will develop indicative results, as defined below, for potential emission reductions and costs of the options. These will be rough estimates based on experience or studies in Arizona or elsewhere and are intended to start off the TWG discussion of the priorities for analysis. Actual Arizona-based estimates will be developed for options that stakeholders decide to pursue in more detail, and may differ significantly from the preliminary indicators.

Indicative Potential Emission Reductions* -	**Indicative cost ($/tCO2e)**
High (H): Potentially capable of saving at least 1 Million Metric Tons CO2e per year by 2020 (~1% of current AZ emissions)	**High (H)**: $50/tCO2e or above
Medium (M): Potentially capable of saving from 0.1 to 1 Million Metric Tons per year by 2020	**Medium (M):** $5-50/tCO2e
Low (L): Unlikely to yield more than 0.1 Million Metric Tons CO2e per year by 2020	**Low (L):** $5/tCO2e or lower
Uncertain (U): Too many unknowns to hazard a guess	**Negative (Neg):** option yields net benefits
** Several measures overlap in terms of the emissions they would reduce. They may target the same emissions sources, but using different implementation pathways. The estimates shown here assume that measures would be implemented independently from, or instead, of other measures.*	

Indication of Priorities:

- **High:** High priority items are deemed deserving of considerable further analysis.
- **Medium:** Medium priority items will be carried forward, with the extent of further consideration and analysis to be determined later.
- **Low**: Low priority items will be moved to a separate list as options to be potentially considered at a later time.

		Priority: High, Med, Low	Implement. Level & Lead	Potential Emission Reductions	Indicative Cost ($/tCO2 removed	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities (currently only includes the latter)
1.	**Residential, Commercial, and Industrial (RCI) Sectors (Comprehensive Approaches)**					
1.1	Utility Demand Side Management (DSM) Programs					
1.2	Cross-sectoral Energy Efficiency Funds or Requirements (e.g. Public Benefit Funds, Utility Savings Goals, or Energy Portfolio Standards)					• Systems Benefit Fund [A1-4] • The Arizona Corporation Commission (ACC) issued a recommended order in a recent Arizona Public Service Co. rate case, supporting a funding level of $16 million per year for APS demand-side management (DSM) programs, an increase from $1 million per year currently.[i]
1.3	Appliance Efficiency Standards					• Arizona recently approved HB2390[ii] - energy efficiency standards for 12 residential and commercial products
1.4	Market transformation and technology development programs (also applies to buildings)					
1.5	Government Agency Requirements and Goals (including procurement)					• Executive Order 2005-05 implementing renewable energy and energy efficiency in new state buildings[iii]
1.6	Negotiated Emissions or Energy Savings Agreements					
1.7	Green Power Purchasing					• APS, SRP, TEP and UES all provide the option for their customers to purchase green poweriv • City of Scottsdale and APS Solar Partners Program [A3-10]

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1.8	Incentives for Renewable Energy Applications (Solar roofs, water heaters, etc.)					• SRP Solarwise [A3-5] • TEP and UES Sunshare PV buydown [A3-8] • Solar and Wind Equipment Sales Tax Exemption [A3-3] • Solar and Wind Energy Systems Tax Credit [A3-2]
1.9	Clean Combined Heat and Power					
1.10	Net-metering policies					
1.11	Time of Use Rates					• APS Commercial Peak Reduction Campaign [A1-6]
1.12	(Additional option, if/as suggested)					•
1.13	(Additional option, if/as suggested)					•

		Priority: High, Med, Low	Implement. Level & Lead	Potential Emission Reductions	Indicative Cost ($/tCO2 removed	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities (currently only includes the latter)
2.	**Residential Sector**					
2.1	Equipment and Appliances: Improve Efficiency and Increase Use of Lower-GHG Fuels					
2.1.1	Consumer education programs					APS provides Consumer's guide s [A1-8]
2.1.2	Focus on specific end-uses/technologies: window AC units, lighting, water heating, plug loads, etc.					
2.1.3	Bulk Purchasing Programs for Public Housing and New Developments					
2.1.4	Appliance Recycling/Pick-Up Programs					Retirement programs typically yield short-lived savings.
2.2	**Residential Buildings: Improve Efficiency and Increase Use of Lower-GHG Fuels**					
2.2.1	Focus on specific market segments: existing homes (weatherization), new construction, apartments, low income, etc.					• The State Energy Office's weatherization program for low-income homeowners [A1-1], [A2-3]
2.2.2	Contractor and Builder Education (e.g. : Proper sizing of HVAC, duct sealing)					• APS and state Energy Office offer building science training [A1-9] • APS subsidizes contractor training [A1-5]
2.2.3	Improved Building Codes					• ASHRAE Standard 90.1-1999 for new state buildings [A2-5] • Pima county and city of Tucson have adopted 2000 International Energy Conservation Code[v] • Phoenix has adopted 2003 IECC[vi] • State has established Energy Code Advisory Commission [A1-9]

		Priority: High, Med, Low	Implement. Level & Lead	Potential Emission Reductions	Indicative Cost ($/tCO2 removed	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities (currently only includes the latter)
2.2.4	Training and Enforcement of Building Codes					
2.2.5	White Roofs, Rooftop Gardens, and Landscaping (including Shade Tree Programs)					• TEP Trees for Tucson program [A2-2]
2.2.6	Education to homeowners					• SRP M-Power [A1-4] • APS on-line information, SRP ESS campaign, TEP on-line information and school program [A1-8]
2.2.7	Training of Building Managers (Apartments, etc.)					*See commercial sector*
2.3	**Other**					
2.3.1	Fuel Switching to less carbon-intensive fuels					• Qualifying Wood Stove Deduction [A3-1]
2.3.2	Marketing Programs					
2.3.3	Introduce in School Curriculum					• Tucson Solar Schools [A1-2]
2.3.4	(Additional option, if/as suggested)					
2.3.5	(Additional option, if/as suggested)					

		Priority: High, Med, Low	Implement. Level & Lead	Potential Emission Reductions	Indicative Cost ($/tCO2 removed	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities (currently only includes the latter)
3.	**Commercial Sector**					
3.1	Equipment and Appliances: Improve Efficiency and Increase Use of Lower-GHG Fuels					
3.1.1	Promotion and Tax or Other Incentives (e.g EnergyStar, credits for solar hot water)					• See residential sector • HB 2381 solar energy feature evaluations for schools and state buildings.
3.1.2	Bulk Purchasing Programs					
3.1.3	Focus on specific end-uses: lighting, water heating, office equipment, power supplies, networked PC management, etc.					• SRP's Lighting Solutions program [A2-2]
3.2	**Commercial Buildings: Improve Efficiency and Increase Use of Lower-GHG Fuels**					
3.2.1	Promotion and Incentives for Improved Design and Construction (e.g. LEED, green buildings)					• See Executive Order 2005-05 above • See Tucson-Pima Sustainable Energy Program [A3-15] • City of Scottsdale Green Building program [A2-5]
3.2.2	White Roofs, Rooftop Gardens, and Landscaping (Shade Trees)					• TEP Trees program [A1-7]
3.2.3	Improved Building Codes					• See residential sector
3.2.4	Training and Enforcement of Building Codes					• Energy office provides training [A1-9]
3.2.5	Increased use of blended cement (substituting fly ash or other pozzolans for clinker reduces CO2 emissions)					
3.2.6	Goals and Reporting for Government Buildings					• See Executive Order 2005-05 above • Solar Design Standards for State Buildings [A3-12]

		Priority: High, Med, Low	Implement. Level & Lead	Potential Emission Reductions	Indicative Cost ($/tCO2 removed	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities (currently only includes the latter)
3.2.7	Building Commissioning and Recommissioning					
3.2.8	Energy Management Training / Training of Building Operators					• Technical assistance from Rebuild Arizona [A2-3] • Arizona Energy Office [A1-9]
3.2.9	Energy Tracking and Benchmarking					
3.3	**Other**					
3.3.1	Clean Combined Heat and Power					
3.3.2	Fuel Switching to less carbon-intensive fuels					
3.3.3	Reinvestment Fund					• Phoenix Reinvestment Fund [A2-4]
3.3.4	Municipal Energy Management					• The Energy Office's Municipal Energy Management Program [A2-3] • Governor's awards for Energy Efficiency [A1-9]
3.3.5	(Additional option, if/as suggested)					
3.3.6	(Additional option, if/as suggested)					

		Priority: High, Med, Low	Implement. Level & Lead	Potential Emission Reductions	Indicative Cost ($/tCO2 removed	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities (currently only includes the latter)
4.	**Industrial Sector**					
4.1	**Improve Efficiency and Increase Use of Lower-GHG Fuels**					
4.1.1	Promotion and Tax or Other Incentives (e.g EnergyStar, credits for solar hot water)					
4.1.2	Bulk Purchasing Programs					
4.1.3	Market transformation and technology development programs, industry coalitions					• The Arizona Coalition for New Energy Technologies [A2-4]. • Arizona Solar Energy Association and Arizona Solar Energy Industries Association, http://www.azsolarcenter.com/arizona/modules/eps.html • Industries of the Future [A1-11]
4.1.4	Focus on specific end-uses: motors, pump systems, boilers, steam system upgrades, process-specific equipment.					
4.1.5	Focus on Small and Medium Enterprises (SMEs)					• ASU Industrial Assessment Center [A1-11] • SRP's Energy Advisor program [A2-2].
4.1.6	Promotion and Incentives for Improved Design and Construction (e.g. LEED, green buildings, expedited permitting)					• See commercial sector
4.1.7	Support for switching to less carbon-intensive fuels (coal and oil to natural gas or biomass)					
4.1.8	Improved Building Codes, Training and Enforcement					• See residential/commercial sector
4.1.9	Energy Management Training / Training of Building Operators					• See commercial sector

		Priority: High, Med, Low	Implement. Level & Lead	Potential Emission Reductions	Indicative Cost ($/tCO2 removed	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities (currently only includes the latter)
4.2	**Other**					
4.2.1	Industry-Specific Emissions Cap and Trade Programs					
4.2.2	Negotiated Agreements					
4.2.3	Industrial ecology/ by-product synergy					
4.2.4	Cement Industry: Clinker reduction/substitution, use of alternative fuels					
4.2.5	Net-metering policies					
4.2.6	Time of Use Rates, Load Management and Curtailment Programs					
4.3	**Reduce High GWP Gas (HFCs, PFCs, SF6) Emissions**					
4.3.1	Participation in Voluntary Industry-Government Partnerships					• Federal voluntary programs for electric power (SF6) and semiconductor (PFC) industries
4.3.2	Process Changes/ Optimization					
4.3.3	Leak Reduction /Capture, Recovery and Recycling of Process Gases					
4.3.4	Use of Alternative Gases (other HFCs, hydrocarbon coolants, etc.)					

[i] http://www.swenergy.org/news/index.html

ii http://www.azleg.state.az.us/FormatDocument.asp?inDoc=/legtext/47leg/1r/laws/0226.htm

[iii] ***(http://www.governor.state.az.us/eo/2005_05.pdf)***

[iv] http://www.epa.gov/greenpower/locator/az.htm

v http://www.azcommerce.com/energy//state%20energy%20code.asp

[vi] http://www.swenergy.org/news/index.html